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(71) Applicant: Borghi, Enzo
Via Romagnoli n. 15
I-40054 Budrio Bologna (IT)

(72) Inventor: Borghi, Enzo
Via Romagnoli, 15
I-40054 Budrio (Bologna) (IT)
Inventor: Antonioli, Gian Enrico
Via Argine Ducale, 122
I-44100 Ferrara (IT)

(74) Representative: Lanzoni, Luciano
c/o BUGNION S.p.A. Via dei Mille, 19
I-40121 Bologna (IT)

(54) A positively anchored retractable tripolar catheter for endocardial pacemaker electrodes.

(57) A flexible tubular casing (1) is fitted at the end farthest from the pacemaker with a ventricular electrode (2) and ensheaths three mutually parallel spiral-wound conductors (3, 7, 11), the first (3) connected at one end by way of a first contact (5) to a first terminal of the pacemaker, and at the other to a helicoid point (6) that can be extended from its initial retracted position internally of the casing (1) by rotating the conductor (3), and corkscrewed into the ventricular cardiac muscle; the second and third conductors (7, 11) connect at one end by way of further contacts (9, 12) with second and third terminals of the pacemaker, and are coupled at their remaining ends to atrial ring electrodes (10, 13) positioned externally of the casing (1) and at dissimilar distances from the point (6); the first contact (5) is taken off separately from the casing (1) so as to permit of connecting the electrodes with the pacemaker by way of separate parallel leads (L, L1), one single core and the other twin core.

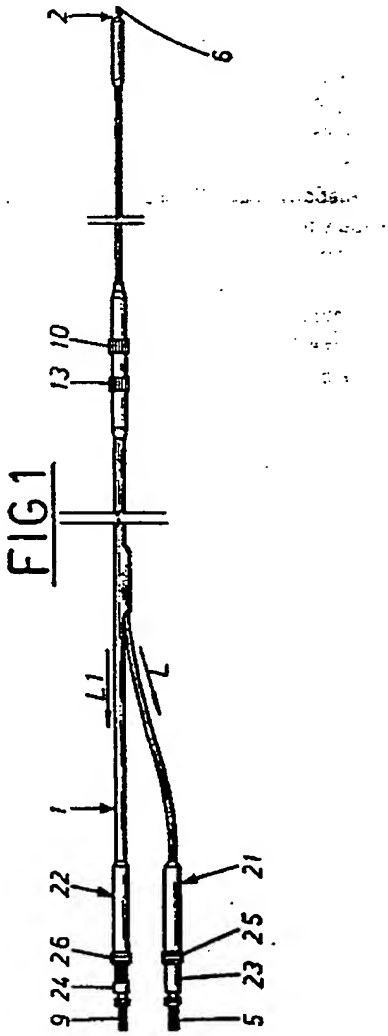

FIG 1

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the present invention comprises a flexible tubular casing 1 fashioned from biocompatible material in such a way as to form a longitudinally insertable element, furnished at the inserted extremity with a ventricular electrode 2 such as can be introduced into the cavity of the heart and used to anchor the catheter positively to the cardiac muscle.

The casing 1 contains three distinct spiral-wound conductors 3, 7 and 11 respectively (see figs 2 to 5); the first, denoted 3, embodied in electrically conductive wire and encompassed by a first tubular sheath of electrically insulating flexible material denoted 4, is rotatable within and axially slidable in relation to the casing 1, and connected at one end by way of a first contact 5 (conventional in embodiment and therefore not illustrated in full), to the first terminal of an implanted cardiac stimulation device (a conventional pacemaker, not illustrated).

The remaining end of the conductor 3 is fastened, for example by a conventional crimping or clinching process, to a helicoid point 6 that constitutes the ventricular electrode 2.

The point 6 is capable of movement, produced by rotation of the spiral-wound conductor 3, from a retracted position internally of the casing 1 to a position extended from the casing in which it can be anchored to the lining of the ventricle.

The second conductor 7, a spiral-wound electrically conductive wire encompassed in like manner to the first conductor 3 by a second sheath 8 similar in all respects to the first sheath 4, and disposed parallel to the first conductor 3 internally of the tubular casing 1, is connected at one end, by way of a second contact 9, to a second terminal of the pacemaker; the remaining end of the conductor 7 is connected to a first ring 10 fashioned from a metal of biocompatible specifications. This first ring 10 (to be described fully in due course), is located externally of the casing 1 (see figs 1 and 4) at a prescribed distance from the helicoid point 6 in such a way as to establish a first atrial contact. The third spiral-wound conductor 11 accommodated by the casing 1, disposed parallel to the first and the second and embodied likewise in electrically conductive wire, is connected at the one end to a third terminal of the pacemaker, by way of a third contact 12, and at the remaining end to a second ring 13 of biocompatible material; this second ring is located externally of the casing 1, isolated and distanced from the first ring 10 (in the example of fig 1, at a greater distance from the ventricular electrode 2), in such a way as to create a second atrial contact.

As illustrated in figs 1 and 2, the first contact 5 (i.e. the ventricular) is separated from the main body of the casing 1 in such a way as to allow of connecting the electrodes to the pacemaker by way of two distinct and substantially parallel leads L and L1 of which the first, serving the ventricular electrode, is unipolar or single core, and the second, serving the atrial electrodes, is bipolar or twin core.

More exactly, the first contact 5 is joined by way of a one-pin connector 21 to the first sheath 4, which emerges from the casing 1 at a position near to the end farthest from the point 6 to provide the one lead L, and the second contact 9 by way of a two-pin connector 22 to the casing 1, of which the corresponding part provides the remaining lead L1; the connectors 21 and 22 consist each in a metal plug 23 and 24 provided with corresponding stop collars 25 and 26 (see fig 1).

The first sheath 4 emerges from the casing 1 by way of a longitudinal slot 20 occupying a relative part of the cylindrical surface of the casing (clearly illustrated in figs 2 and 3).

The first and second atrial electrode rings 10 and 13 are associated with respective first and second couplers 14 and 15 disposed radially and sealed internally of the casing 1; each such coupler 14 and 15 affords a corresponding socket 14a and 15a, radially offset one from the other and from the first spiral-wound conductor 3 (fig 5), by way of which electrical contact is established between the atrial electrodes 10 and 13 and their respective conductors 7 and 11.

Observing figs 4 and 5, each of the couplers 14 and 15 associated with the first and second rings 10 and 13 will be seen to comprise a sleeve 16 and 17 associated radially with the internal circumference of the respective first and second ring 10 and 13 and insertable into the corresponding part of the casing 1 by way of and in sealed association with a longitudinal slot 1a and 1b. Each sleeve 16 and 17 accommodates a respective coaxial pin 18 and 19 fashioned in electrically conductive material, over which the end of the corresponding spiral-wound conductor 7 and 11 is coaxially and stably secured. The remaining ends of these two conductors 7 and 11 converge into the relative pacemaker connector 22 (see also fig 6) and combine with the casing 1 and the respective second and third contacts 9 and 12 to provide the twin core lead L1.

A cardiac catheter embodied in this manner affords notable advantages in comparison to conventional types, first among which is that the ventricular electrode remains electrically and mechanically independent from the remainder of the catheter and can be anchored to the lining of the heart easily and precisely (several times if necessary) without manipulating the remaining parts of the casing; the relative spiral-wound conductor 3 can be of minimal diametral dimensions moreover (a factor reflecting favourably on the overall dimensions of a tripolar embodiment) without prejudice to its mechanical strength and manoeuvrability.

The second and third spiral-wound conductors effect a dual atrial control by monitoring haematic flow at two locations, independent of and remote from one another, thereby returning two signals to the sensing

disposed and sealed within the casing and affording a corresponding socket (15a), radially offset from the first and second spiral-wound conductors (3, 7), in which to accommodate the end of the third spiral-wound conductor (11); and

in that the first contact (5) is separated from the casing (1) in order to permit of connecting the electrodes and the pacemaker by way of two distinct and substantially parallel leads (L, L1), the one unipolar and the other bipolar.

3) An electrode catheter as in claim 2, wherein the first coupler (14) and the second coupler (15) consist in respective sleeves (16, 17) disposed radially and within the circumference of the first and second rings (10, 13) and insertable into the casing (1) by way of and in sealed association with corresponding longitudinal slots (1a, 1b), and in respective electrically conductive pins (18, 19) accommodated coaxially by the sleeves (16, 17), over which the corresponding ends of the second and third conductors (7, 11) are coaxially and stably secured.

4) An electrode catheter as in claim 1 or 2, wherein the unipolar lead (L) coincides with a part of the first sheath (4) that emerges from the casing (1) near to the connection with the pacemaker by way of a longitudinal slot (20) formed in the cylindrical surface of the casing and is joined to the first contact (5) by way of a relative connector (21) associated with the pacemaker.

5) An electrode catheter as in claim 1 or 2, wherein the bipolar connecting lead (L1) coincides with parts of the second and third conductors (7, 11) that converge internally of the casing (1) toward substantially coaxial second and third contacts (9, 12) and are joined to a single connector (22) associated with the pacemaker.

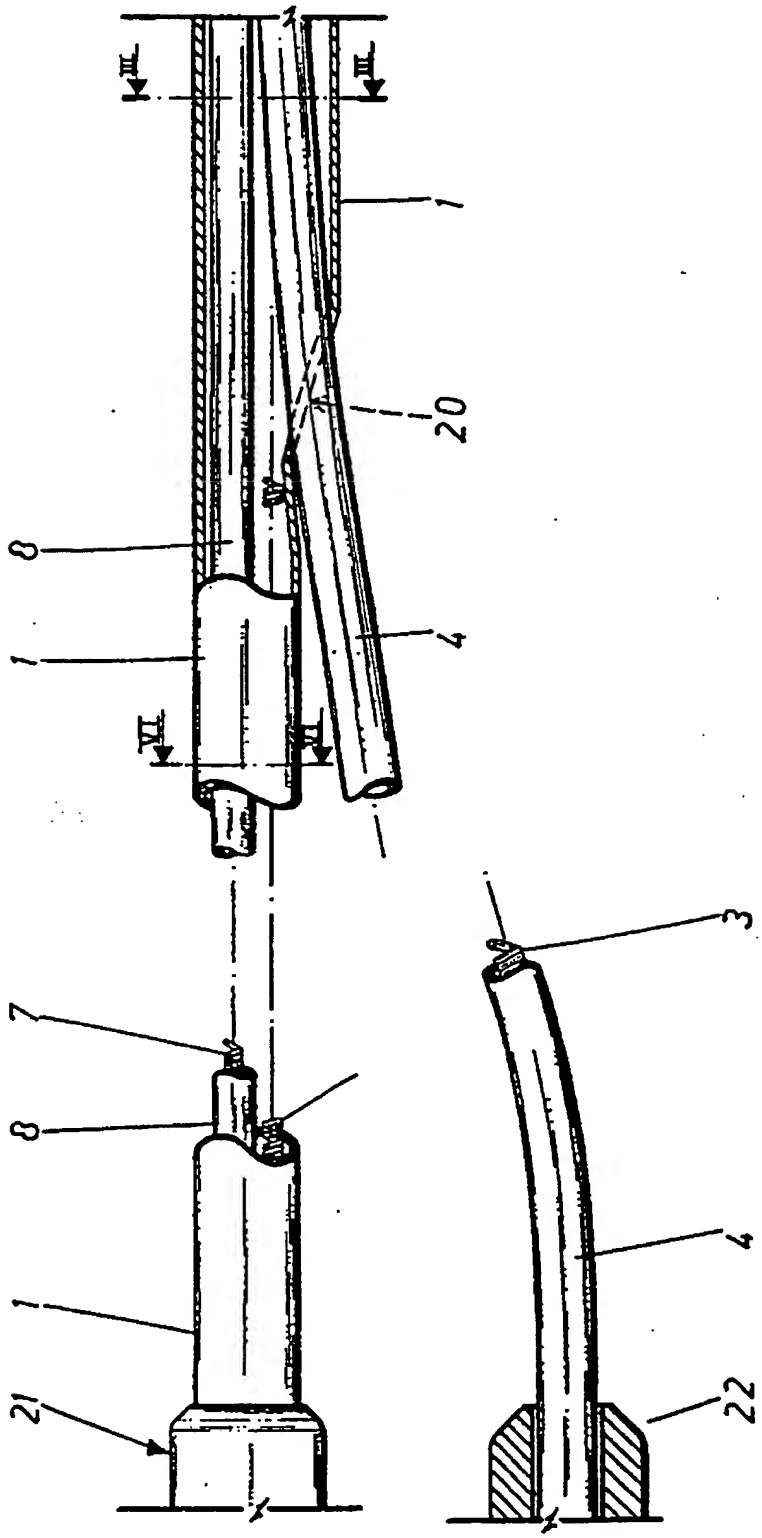


FIG 2

FIG 6

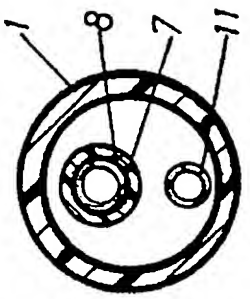


FIG 5

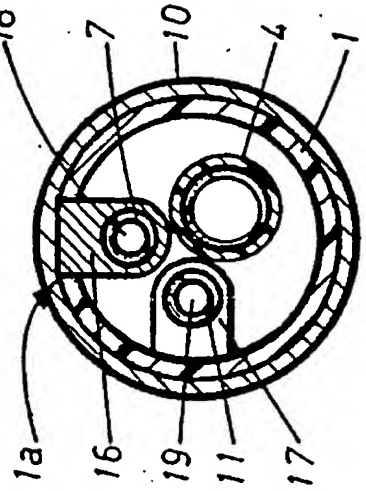


FIG 3

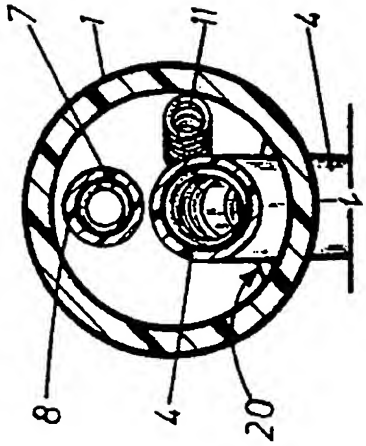
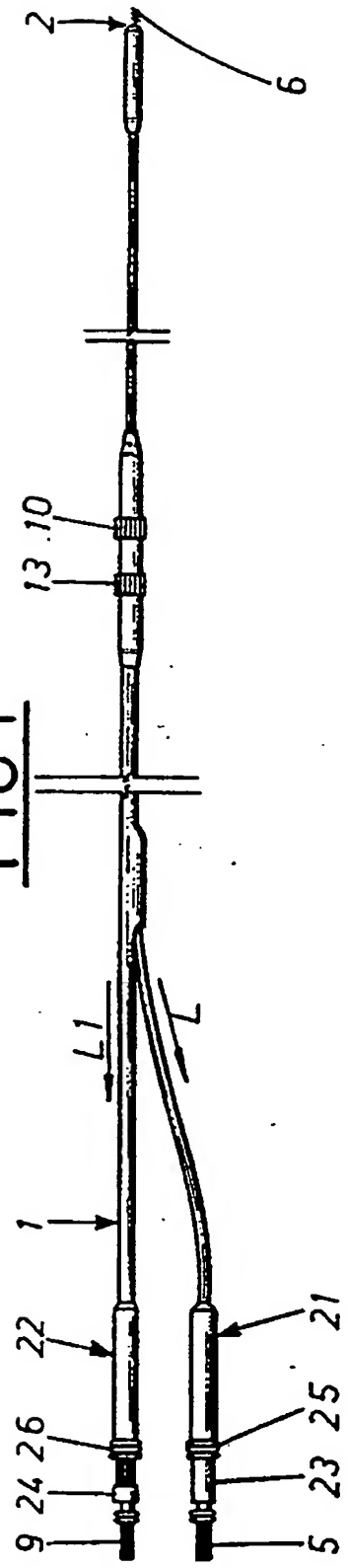


FIG 1



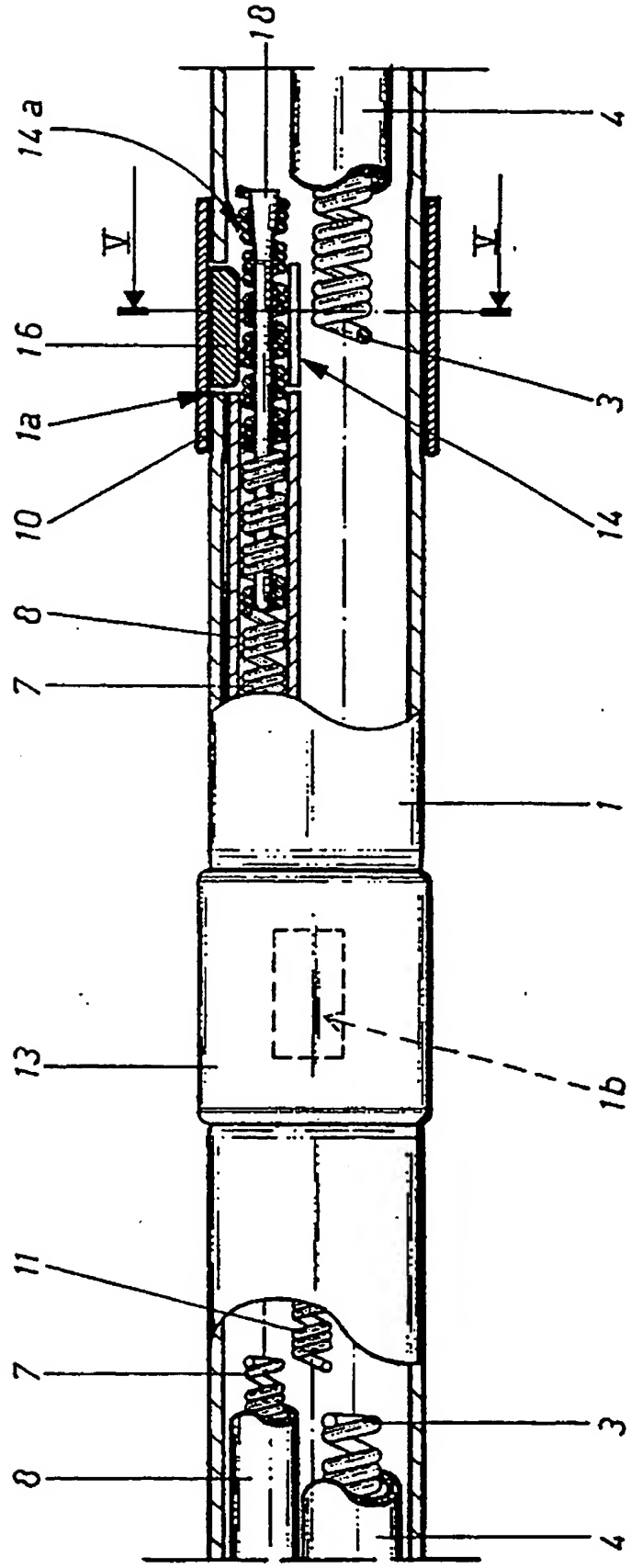


FIG 4